

# Optimising Breast Planning for Large Separation Patients

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## Background

Here at the BWoSCC we have found that breast patients with a chest wall separation of >26cm require higher energy photons (>6MV) to achieve clinically acceptable plans.

Approximately 1800 courses of breast radiotherapy are delivered per annum in our clinic but only around 44 of these utilised 16MV and the main reason for this was patient separation and size.

This retrospective study evaluated if there were potential benefits in using intensity modulated radiotherapy (IMRT) with either flattened 10MV or flattening filter free (FFF) 10MV compared to conventional 16MV planning.

## Method

Ten patients previously treated using 16MV photons and planned using Eclipse™ v13.6 were randomly selected.

IMRT plans were then generated for each of the ten patients using 10MV IMRT and 10FFF IMRT. Planning was performed using current planning objectives and dose constraints. Differences in dose volume histogram parameters were calculated to assess plan quality. The plans were evaluated based on the Planning Target Volume (PTV) coverage, with dose constraints of;

	Acceptable	Optimal
Heart	V10Gy ≤ 5% V2Gy ≤ 25%	
	Mean ≤ 3.5Gy	Mean ≤ 3.0Gy
Lung	V12Gy ≤ 17%	Lung V12Gy ≤ 15%

The PTV Homogeneity Index (HI) was calculated using the given formula:

$$HI = \frac{D_5}{D_{95}}$$

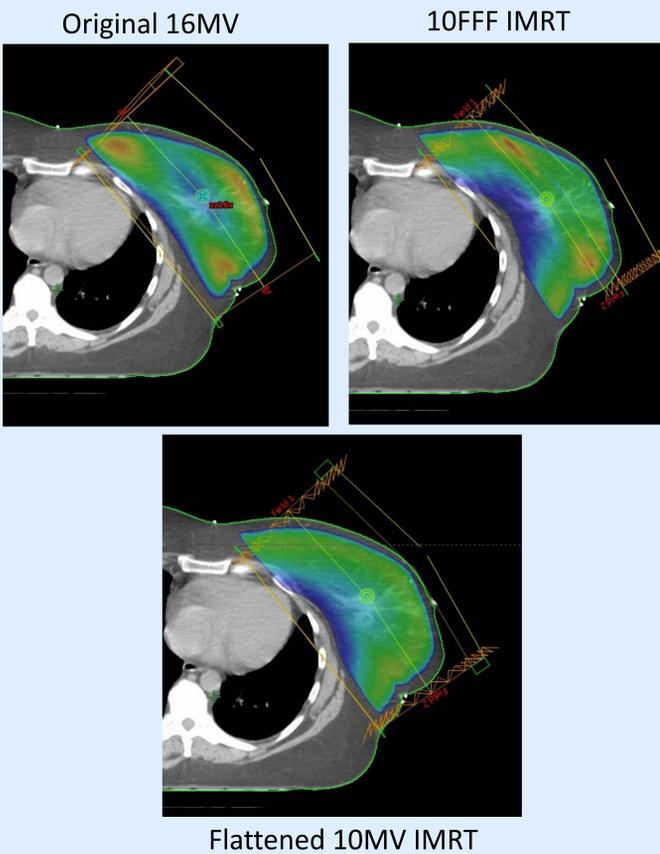
where:

$D_5$  = dose to 5% of the target volume,

$D_{95}$  = dose to the 95% of the target volume,

Significance was assessed by two-tailed t-test ( $p < 0.01$ ).

## Dose Distributions (98% Colour wash)



## Results

Modality	Mean HI	HI Range		HI T-Test Result
16MV	1.12	1.11-1.14	10MV IMRT / 10FFF IMRT	0.00
10FFF IMRT	1.13	1.09-1.17	16MV / 10MV IMRT	0.36
10MV IMRT	1.12	1.10-1.15	16MV / 10FFF IMRT	0.23

Table 1

Table 2

Modality	Mean Heart V10Gy (%)	Mean Heart V2Gy (%)	Mean Lung V12 Gy (%)
16MV	0.6	7.5	7.7
10FFF IMRT	0.7	6.3	7.8
10MV IMRT	0.7	7.9	9.5

Table 3

- When comparing the HI results for the PTV coverage there was no significant difference between the conventional 16MV plans and either 10MV flattened or FFF IMRT plans
- There was however a significant difference between 10MV flattened and FFF IMRT plans with 10MV IMRT demonstrating an increase in D95% and D90% coverage of the PTV.
- The FFF IMRT plans demonstrated a reduction in the heart V2Gy doses when compared with Flattened 10MV
- The FFF plans met local dose constraints in 80% of occasions, the flattened IMRT plans met constraints on 90% of occasions and the 16MV plans met constraints on 100% of occasions.
- On all occasions the flattened IMRT and 16MV plans gave clinically acceptable plans.

## Dose-Volume Histograms

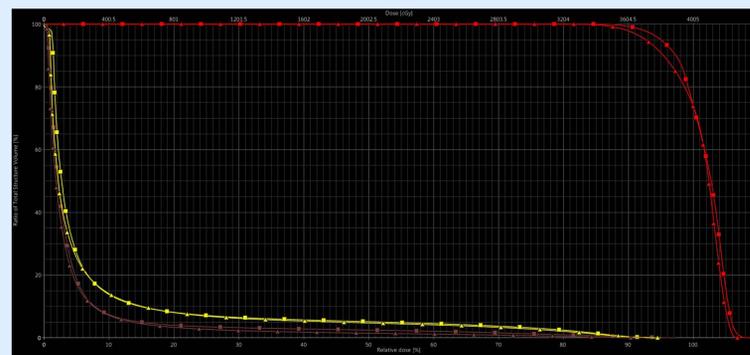


Figure 1: Example of a 16MV plan compared to a 10FFF IMRT plan. 16MV is represented by squared line, FFF IMRT is represented by triangular line. Red Curve = PTV, Yellow Curve = Lung Dose, Brown curve = Heart dose

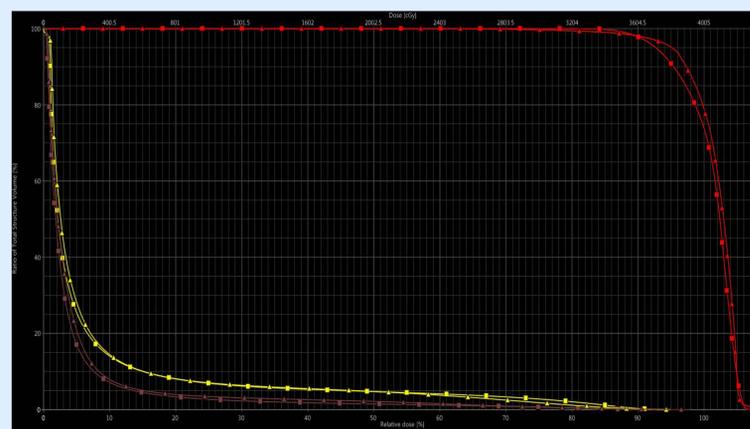


Figure 1: Example of a 16MV plan compared to a 10MV IMRT plan. 16MV is represented by squared line, MV IMRT is represented by triangular line. Red Curve = PTV, Yellow Curve = Lung Dose, Brown curve = Heart dose

## Conclusion

For this cohort of large breast patients both 10MV flattened IMRT and 16MV conventional planning gave clinically acceptable plans. In our centre 10MV flattened IMRT will be commissioned and implemented for these clinical situations.